



**2009-2010** TENNESSEE GUIDE TO



**CLEAN TECHNOLOGY**

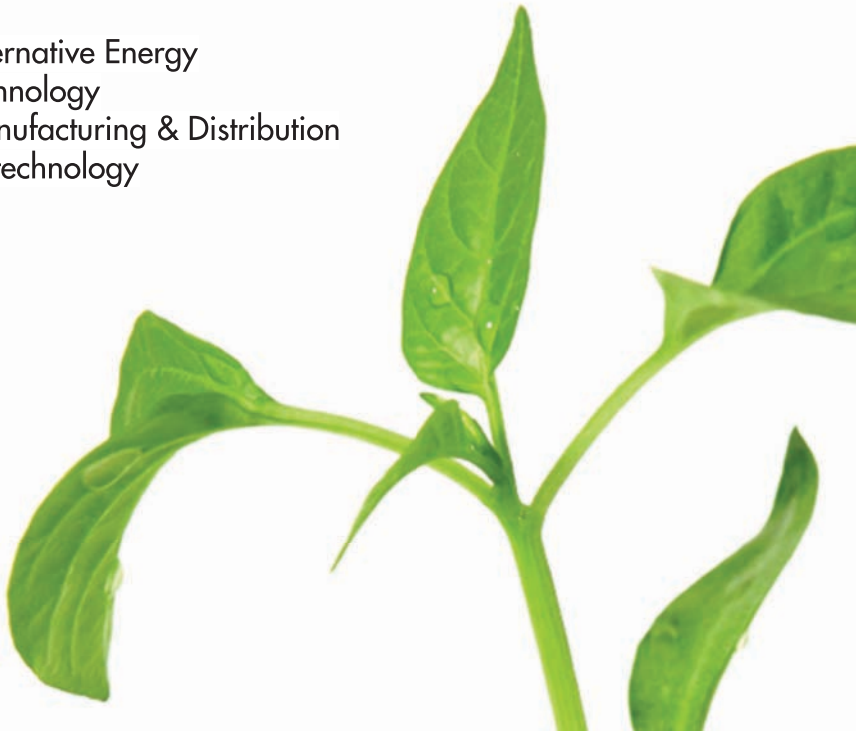
Tennessee Department of Economic & Community Development



# Clean Technology in Tennessee

Tennessee is highly focused on the development of clean-energy research, technology and products. Our state has already invested in job creation and economic development in the fields of renewable energy, alternative fuels, energy conservation, solar photovoltaics, and electric and hybrid vehicles. Highlights from across the state include:

Alternative Energy  
Technology  
Manufacturing & Distribution  
Biotechnology



## DID YOU KNOW?

In March 2008 Governor Phil Bredesen signed an Executive Order establishing the Governor's Task Force on Energy Policy charged with helping Tennessee become a leader in energy efficiency and conservation, the use of alternative fuels and renewable energy, and in the development of clean-energy technology.

The Task Force has four key goals and objectives:

- Develop opportunities for state government to lead by example in energy efficiency and conservation, with emphasis on efficient building construction and vehicle fleet management;
- Develop prospective policies, legislation, or incentives in an effort to encourage statewide energy efficiency and conservation in both public and private sectors;
- Spearhead public-private partnerships and collaborations in order to encourage research and development of clean-energy technology and increase the economic development potential in the state's energy sector; and
- Develop strategies for expanding the use of alternative fuels and renewable energy sources to support the sustainability of Tennessee's environment.

## ALTERNATIVE ENERGY

Tennessee is positioned to be a leader in wind, solar and nuclear energies. New solar component suppliers Hemlock Semiconductor and Shoals Technologies have joined Sharp Corporation, the world's leading manufacturer of solar photovoltaics, in calling Tennessee home. With a ready workforce, dedicated industrial megasites and central geographic location, many alternative energy companies already call Tennessee home. Companies include solar panel component producers Sharp Electronics in Memphis, AGC Flat Glass in Kingsport and wind turbine manufacturer Aerisyn Energy in Chattanooga. The Tennessee Valley Authority (TVA) has a wind farm on Oak Ridge's Buffalo Mountain that produces enough energy to power more than three million homes. Through the University of Tennessee Biofuels Initiative (UTBI), the state is investing in efforts to decrease dependency on foreign oil and increase rural economic development and domestic energy production within Tennessee.

## TECHNOLOGY

Tennessee is home to Innovation Valley, one of the country's largest data pipelines. This technology infrastructure provides state-of-the-art technological infrastructure and incubation to businesses statewide. Leading Fortune 500 companies such as FedEx and Dell along with institutions such as the SIM Center in Chattanooga, a national center for computational engineering, and the Oak Ridge National Laboratory (ORNL), which houses the world's fastest supercomputer for sciences, offer some of the most advanced technology applications in the world. ORNL is home to two of the most advanced neutron scattering scientific research facilities in the world – the High Flux Isotope Reactor (HFIR) and the Spallation Neutron Source (SNS) – drawing scientists worldwide.

### DID YOU KNOW?

- Governor Phil Bredesen and Senator Howard Baker hosted the first ever Summit on Clean Energy Technology September 14-15 in Knoxville. The 1 1/2 day summit was sponsored by Oak Ridge National Laboratory and the Tennessee Valley Authority.

## MANUFACTURING & DISTRIBUTION

Tennessee is a well-oiled manufacturing and distribution machine, located within a day's delivery of 76 percent of the nation's major markets. With ample transportation and development infrastructure, including six major interstate highways, 3 major railroad lines, 5 regional and 2 international airports, river ports, and 5 foreign-trade zones, it is easy to see why leading companies such as FedEx, Boeing, Dell, Sears, Nike, Clayton Homes, and Louisiana Pacific all have major operations in Tennessee. Memphis alone boasts 195 truck terminals, rail yards for each of the nation's top four railroads and the world's busiest cargo airport. Nissan North America, Volkswagen and General Motors call Tennessee home, creating a ripple effect upon automotive suppliers as well. With its proximity to the growing supplier base in the South, inexpensive labor, and ample transportation and developmental infrastructure, Tennessee has been the southern leader in automobile manufacturing over the past two decades.

## BIOTECHNOLOGY

With nearly 300 life science and renewable energy companies operating within the state, Tennessee is poised to deliver stable, sustainable energy solutions and scientific breakthroughs to power business and growth over the next century. In Memphis, the UT-Baptist Research Park is a leading center for biotechnology, with 1.2 million square feet of state-of-the-art lab, research, education and business development space available. Middle Tennessee is also home to the Cool Springs Life Sciences Center, a 21st century campus with 140,000 square feet of planned space designed to meet the unique needs of bioscience and biotechnology firms such as BioMimetic Therapeutics, an emerging leader in regenerative medicine. Tennessee is also home to world-renowned research institutions St. Jude Children's Research Hospital in Memphis and Vanderbilt University Medical Center in Nashville that attract leading minds and resources to biotechnology growth in the state.

### **Biofuel Technology and Governor Bredeesen's Leadership in Green Energy**

Genera Energy, the University of Tennessee Biofuels Initiative and DuPont Danisco Cellulosic Ethanol, LLC, launched a collaborative effort to produce ethanol fuel from switchgrass and other forest and agricultural biomass. The pilot, with a refinery in Vonore, is projected to create 4,000 new jobs, additional plants supporting biofuel production, \$100 million annually in new farm revenue, and 1 billion gallons of Grassoline annually.



### **DID YOU KNOW?**

- The Governor's Task Force on Energy Policy includes representatives of four state agencies, including the Commissioner Matt Kiser of Tennessee's Department of Economic & Community Development.

## TENNESSEE PARTNERSHIPS

The President and CEO of Nissan, Carlos Ghosn, announced that the company will to work jointly with the State of Tennessee and TVA to develop a charging network for plug-in electric vehicles in Middle Tennessee. This public infrastructure effort is in part to promote the use of and production of zero-emission vehicles. Nissan plans to start producing zero emission electric vehicles in 2010. The partnership with Nissan, now

headquartered in Tennessee, marks a new era in the state's path to respond to climate change and promote the development of green jobs.

Volkswagen chose Chattanooga for a \$1 billion environmentally responsible manufacturing plant. This plant plans to create up to 2,000 new jobs in an effort to produce efficient and affordable new cars for the North American market.

**These landmark partnerships have lead to forward thinking Tennessee incentives including:**

### The Green Energy Tax Credit

*As part of a comprehensive energy strategy, Tennessee offers the Green Energy Tax Credit to certified green energy supply chain manufacturers. The credit will be granted in an amount equal to any carbon tax levied by the Tennessee Valley Authority on a certified manufacturer's energy bill. The credit is to be used to offset the certified manufacturer's franchise and excise tax liability. Any tax credit which cannot be used to benefit a certified manufacturer during a fiscal year may be returned to the taxpayer in the form of a cash overpayment. TVA has agreed to supply necessary information to the Commissioner of Revenue to verify the amount of the credit.*



### Pollution Control Equipment Tax Credit

*If a company obtains certification from the Tennessee Department of Environment and Conservation indicating that the company's purchase of pollution control equipment is mandated by state, federal or local law and the equipment will result in the reduction of pollution in the water or air or the elimination of hazardous wastes, the equipment can be taxed at salvage value for the purposes of calculating tangible personal property tax. The certificate will also exempt the equipment from sales and use tax and exclude it from calculation of a company's franchise tax liability.*

## **TENNESSEE PARTNERSHIPS**

### **The Green Island Corridor Grant Program**

Administered by the Tennessee Department of Transportation (TDOT), this program assists retail vehicle fuel stations and farm co-ops with up to 80 percent of the cost to convert or install storage and fuel dispensing equipment for E85 and B20 pumps, with a cap of \$45,000 per pump. TDOT advertises biofuel station locations on the Official State Map and provides interstate signage at exits with participating biofuel stations. This program is working to establish a statewide network of E85 and B20 pumps along interstate and major highway corridors to make these fuels available to all.

### **Tennessee Small Business Energy Loan Program**

Companies with fewer than 300 employees or less than \$3.5 million in annual gross sales are eligible to apply for low interest loans of up to \$300,000 to upgrade energy efficiency in buildings and plants and to improve the efficiency of manufacturing processes. Companies may install insulation, double pane windows, energy efficient heating and cooling systems, and energy efficient lighting among the steps companies can take in an effort to lower energy costs. ECD can also arrange for energy audits of qualifying businesses.

### **Local Government Energy Efficiency Loan Program**

ECD offers low interest loans to municipal and county governments to fund energy related improvements to courthouses, administration buildings, schools, maintenance facilities and other buildings owned by local government. Even if a local government doesn't apply for the loan program, the Energy Division will arrange for an energy audit to provide technical assistance to communities interested in lowering their energy costs. The loan maximum for each community is \$500,000 annually; interest rates are 0% for Three Star certified communities, 3% for all others with loans amortized over 7 years.

## TENNESSEE PARTNERSHIPS

### Tennessee Clean Energy Technology Grant Program (TN-CET)

ECD offers grants to offset the cost of businesses installing clean energy technology such as solar systems, solar electric generating equipment, wind energy systems, solar thermal systems, hydrogen fuel cells and hybrid solar lighting. The maximum available grant amount is 40% of the installed system cost up to \$75,000. Grant dollars are allocated on a “reimbursement basis” only and a contractor’s design and installation proposal must be submitted with the application.

### Biodiesel Infrastructure Grants

ECD offers each county one grant to defray the cost of installing biodiesel fuel tanks, pumping equipment and card readers. Local communities can reduce fuel costs by utilizing biodiesel in school buses, maintenance vehicles, heavy equipment or any other vehicle powered by diesel fuel. Biodiesel fuel produces fewer pollutants and can be used in existing diesel powered vehicles without the cost of retrofitting. Local matching funds are required to qualify, but may take the form of land, equipment and/or labor.

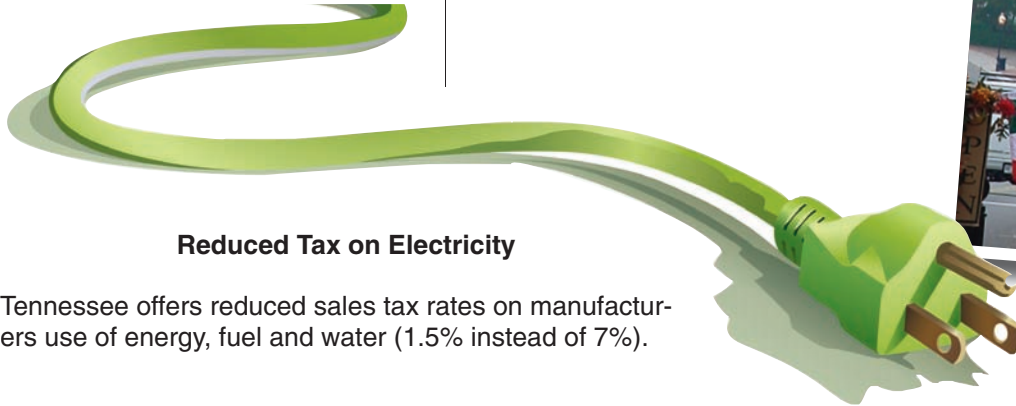
### Main Street Lighting Program

ECD can provide matching grants to communities to assist with the purchase and installation of energy efficient outdoor lighting in main business districts. The program provides 50% matching funds of up to \$20,000 for each project. Local matching contribution may be in-kind. Applicants must undergo an energy audit and may receive reimbursement upon project completion.



### Reduced Tax on Electricity

Tennessee offers reduced sales tax rates on manufacturers use of energy, fuel and water (1.5% instead of 7%).



## RESEARCH PARTNERSHIPS

A team led by Oak Ridge National Laboratory in Oak Ridge, Tennessee was awarded a \$125 million grant in June 2007 by the Department of Energy to build a Bioenergy Science Center. The new facility is headquartered on the campus of ORNL and develops processes for converting plants, including switchgrass and poplar trees, into fuels.

Extensive research by ORNL and the University of Tennessee has shown that switchgrass is perfectly suited to the southeastern climate. It grows in poor soil, can withstand floods and droughts, and is resistant to pesticide and diseases.

es. UT has purchased all available quantities of switchgrass seed in the country for further research, and farmers in East Tennessee already have fields planted.



The University of Tennessee Biofuels Initiative (UTBI) is a five year, \$70 million commitment from the State of Tennessee. In 2007, the legislature appropriated \$40.7 million for capital construction and \$8.25 million for research, farmer incentives, and operating incentives for the Biofuels Initiative. The goal is to produce switchgrass, a non-food crop not previously grown commercially in Tennessee, through a farmer incentive program, and to construct and operate a pilot biorefinery with the capacity to produce 5 million gallons of cellulosic ethanol per year.

### DID YOU KNOW?

- The Summit on Clean Energy Technology explored practical ways to move Tennessee forward in the clean tech sector and ensure that the state is at the leading edge in creating high quality jobs that support clean energy and the environment.



## EDUCATION

The Energy, Environment, and Resources Center (EERC) at the University of Tennessee-Knoxville (<http://eerc.ra.utk.edu/>) finds real-world solutions to problems related to the environment, energy, economic development, and technology. Through multidisciplinary research, EERC staff has assisted federal, state, and local governments as well as the private sector. Research by the EERC has contributed to waste and related environmental impacts to increase energy efficiency, to strengthen planning processes, and to use new technology wisely.

### Tennessee's Investment in Higher Education

In 2007-2008, the State of Tennessee appropriated \$973,744,500 for state universities, community colleges and vocational schools. From 2006 – 2007, 21,606 students received over \$45 million in state grants and scholarships offered through the Tennessee Student Assistance Corporation. In addition, more than 67,000 students participated in the Tennessee Education Lottery Scholarship Program which awarded nearly \$192 million scholarships over that same period. In the fall of 2007 the total enrollment at Tennessee's Post-Secondary Institutions was over 300,000.



### Oak Ridge National Laboratory

Many successful high school seniors have participated in the Oak Ridge National Laboratory summer research program designed to encourage students to pursue careers in science and mathematics. The ORNL, a multi-program science and technology laboratory that conducts research aimed at strengthening national leadership in key scientific areas, also holds summer day camps, the Annual Junior Science and Humanities Symposium, and additional programs for students ranging from kindergarten to 12th grade. Furthermore, in an effort to enhance and upgrade science classrooms and laboratories, UT-Battelle LLC., which manages the ORNL, has given a series of \$10,000 donations to more than 30 Tennessee high schools since 2000.

### Governor's Academy for Math and Science

The first Governor's Academy for Math and Science opened its doors in August 2007. This two-year residential program is designed for the best and brightest math and science students from across the state. Located in Knoxville, Tenn., students travel to laboratories at UT and ORNL to learn and assist in research. Three new Governor's Schools have been added for this summer focusing on high-level math and science skills, including computational physics, emerging technologies, and scientific models and data analysis. These schools are in addition to nine other Governor's Schools in Engineering, Arts, Technology, Leadership, and Agricultural Science fields. Additionally, the Agricultural Science Program offers a biofuels course where students produce their own ethanol for engine use.

## TENNESSEE'S COMMITMENT TO CLEAN ENERGY TECHNOLOGY

On Feb. 26, 2009, Tennessee Governor Phil Bredesen joined Economic and Community Development Commissioner Matt Kisber, Dr. Rudolph Staudigl, President and CEO of Wacker Chemie AG of Munich, Germany and Dr. Ingomar Kovar, President of Wacker Chemical Corporation, Adrian, Mich., in announcing the company's plans to build a \$1 billion facility for the manufacture of hyperpure polycrystalline silicon in Bradley County. Polycrystalline silicon is a primary component used in the manufacture of solar panels and semiconductors. The project is expected to create more than 500 new jobs for the region.

Tennessee is working hard to position itself to take advantage of a revolution in manufacturing that could bring thousands of new, high-wage "green energy" jobs in such fields as biofuels, solar and wind energy. Industries that focus on alternative energy are expanding, despite the recession.

While competition among states for new jobs is expected to be fierce, Tennessee has already landed a number of companies involved in sustainable-energy technologies and is well positioned to

attract more, according to a University of Tennessee economics expert and officials involved in the state's efforts.

At Gov. Phil Bredesen's urging, the state began a focused campaign to lure green-energy jobs. The work already has paid off with the announcement in December 2008 that Hemlock Semiconductor Corp. of Michigan would invest \$1.2 billion to build a plant in Clarksville to manufacture polysilicon, a key component of solar-electric panels. Initially, the facility will provide 800 jobs, but it has the potential to expand significantly.



*Aerospace Testing Alliance (ATA) Outside Machinist Carey Wofford inspects the leading edges on the standard check model between tests in Arnold's 16T. ATA is the support contractor for AEDC. (Photo by Rick Goodfriend)*

### DID YOU KNOW?

Besides attracting the new Clarksville facility, Tennessee has green-energy industries in other locations also.

- **In Memphis, Sharp Electronics Corp. builds solar-energy panels.**
- **In Chattanooga, Aerisyn Energy builds components for power-generating wind turbines.**
- **AGC Flat Glass makes glass for solar panels in Kingsport.**
- **DuPont Danisco Cellulosic LLC, in partnership with the University of Tennessee Research Foundation, is building a pilot facility to produce the biofuel ethanol from nonfood sources in Vonore.**

## Volunteer State Solar Initiative

Governor Phil Bredesen recently proposed the Volunteer State Solar Initiative, a comprehensive solar-energy and economic development program that will use up to \$62.5 million in Federal American Recovery and Reinvestment Act funds to advance job creation, education, research, and renewable power production in Tennessee. In announcing the new initiative, Bredesen was joined by legislative leaders and key partners including Oak Ridge National Laboratory (ORNL), the Tennessee Valley Authority (TVA), and the University of Tennessee (UT). Support was registered from Washington, D.C., by members of Tennessee's congressional delegation, including U.S. House Science and Technology Committee Chairman Bart Gordon and Congressman John Tanner, a member of the House Ways and Means Committee.

**Subject to approval by the U.S. Department of Energy (DOE) and the Tennessee General Assembly, the proposed initiative consists of two closely related projects:**

- The Tennessee Solar Institute at UT and ORNL, which will focus on basic science and industry partnerships to improve the affordability and efficiency of solar products; and
- The West Tennessee Solar Farm near Brownsville, a five-megawatt 20-acre power generation facility at the Haywood County industrial megasite that will be one of the largest installations in the Southeast and serve as a demonstration tool for educational, research and economic-development purposes.

## DID YOU KNOW?

### TVA's Solar Power Generating Sites

- These sites offer high visibility and good opportunities for public education. By stimulating public interest in and demand for solar power, TVA intends to encourage further technological development that could help bring the cost down over time.
- TVA has established photovoltaic (PV) systems to generate solar power at nine locations across Tennessee:
  - ✓ Adventure Science Center – Nashville
  - ✓ Dollywood Site #1 – Pigeon Forge
  - ✓ Dollywood Site #2 – Pigeon Forge
  - ✓ Ijams Nature Center – Knoxville
  - ✓ Cocke County High School – Newport
  - ✓ American Museum of Science and Energy – Oak Ridge
  - ✓ Finley Stadium – Chattanooga
  - ✓ BRIDGES Center – Memphis
  - ✓ Morgan County Vocational Technical School – Wartburg

## Tennessee Solar Institute

The Tennessee Solar Institute will be located at the University of Tennessee and Oak Ridge National Laboratory campuses in Knoxville and Oak Ridge. At UT, the institute will anchor the new Joint Institute for Advanced Materials, a previously funded shovel-ready 132,000-square-foot facility that will be the first building in the university's new Cherokee Farm Innovation Campus. At ORNL, the institute will take advantage of existing world-class DOE research assets including the Spallation Neutron Source and the world's most powerful supercomputers.

The institute will support Tennessee's economic growth strategy and advance U.S. competitiveness by bringing together industry and research activities to improve the conversion of solar energy into electricity and increase the capacity of key technologies for storing electrical energy. One ultimate goal: Make solar technologies more affordable and efficient, which will help accelerate their adoption in the U.S. and globally. Short-term efforts will be accomplished in part through increased hiring of graduate research scholars, postdoctoral fellows and support staff at UT.

Conversations with manufacturers have begun about how the Solar Institute can best support their needs as well as how the institute can support utilities, government agencies, consumers, and other stakeholders.

Among other activities, the Solar Institute will pursue industry partnerships to improve existing manufacturing processes as well as incubate solar photovoltaic start-up firms and advance laboratory processes into pilot manufacturing efforts. Additionally, the institute will work with the affiliated Solar Farm to demonstrate new technologies and examine the large solar array's interaction with the region's electrical grid.



## Knoxville 2008 Solar America City

In March of 2008, the Department of Energy (DOE) named the City of Knoxville a partner in its Solar America Cities Program. Through this partnership, Knoxville will be awarded \$200,000 over a two-year period to help finance various initiatives developed to reduce barriers to local generation of solar power. In support, TVA is matching this grant with \$50,000 annually. DOE will also contribute \$200,000 worth of technical assistance towards the program initiatives, while TVA and the Knoxville Utility Board have both pledged additional technical and staff assistance.

**The Solar America Cities partnership will jump start progress towards this goal by helping to fund the following initiatives:**

1. Installation of a 4.8 kW solar power generation system at the new, LEED-certified downtown transit center.
2. Integration of solar power in Community Development plans for affordable housing construction and renovation.
3. Design and financing of an educational exhibit to accompany the existing 15 kW solar power array at Ijams Nature Center.
4. Identification of local companies focused on solar

power, renewable energy, energy-efficient technologies and assessment of the challenges these companies face in increasing local demand.

5. Development of a website and other publicity materials that explain the technological and financial options available to those interested in installing a solar power system.
6. Development of locally offered, high quality solar installation certification courses to strengthen the local supply market.
7. Creation of technical training programs to educate relevant Knoxville, Knox County, and KUB staff on solar power generation such that solar power systems can be installed in a safe and timely manner.

Source: City of Knoxville – [www.cityofknoxville.org](http://www.cityofknoxville.org)



Aerospace Testing Alliance (ATA) Outside Machinist Carey Wofford inspects the leading edges on the standard check model between tests in Arnold's 16T. ATA is the support contractor for AEDC. (Photo by Rick Goodfriend)

## West Tennessee Solar Farm

The West Tennessee Solar Farm will be located at the new Haywood County industrial megasite in a partnership with TVA, the nation's largest public power company. Under a preliminary agreement, TVA will purchase power generated by the Solar Farm at a renewable energy price. Proceeds from power sales will be reinvested in the site for maintenance, expansion and improvement.

From an economic development standpoint, the Solar Farm will be a unique asset to market to rural Haywood County to new industry, including renewable-energy product and equipment manufacturers that may be considering expanding in Tennessee.

Moreover, the farm will serve as a showcase for Tennessee-made solar products and components such as panels assembled by Sharp Solar Energy Solutions Group, which operates a nearby manufacturing facility in Memphis, and glass produced by AGC Flat Glass, which has a longstanding manufacturing presence in Northeast Tennessee.

Additionally, the farm will include materials produced by more recent entrants to the Volunteer State, including Hemlock Semiconductor and Wacker Chemie AG, both producers of polycrystalline silicon, a key precursor element in photovoltaic solar panels. Product orders will represent a boost in short-term production for manufacturers such as Sharp and AGC Flat Glass and result in downstream economic activity associated with the installation.

In addition to supporting the Solar Institute's research mission, the Solar Farm will serve as an educational site for students and the public. The farm, which will be located at a site to be determined along Interstate 40, will be Tennessee's largest solar installation to date and one of the largest in the Southeast. Demonstrating the zero-carbon production of electricity on a highly visible and significant scale is expected to encourage future renewable-energy interest and investments.



*Glass produced by AGC Flat Glass, a Tennessee product, will be showcased at the farm.*



## **KINGSLEY BROCK**

BUSINESS DEVELOPMENT DIVISION

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[HTTP://WWW.TNECD.GOV](http://www.tnecd.gov)



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